Assessment of the Northern rock sole stock in the Bering Sea and Aleutian Islands

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Executive Summary

Northern rock sole (*Lepidopsetta polyxystra*) are assessed on a biennial stock assessment schedule as part of the National Marine Fisheries Service assessment prioritization plan implemented in 2017. For Bering Sea/Aleutian Islands partial assessments, an executive summary is presented to recommend harvest levels for the next two years. Please refer to last year's full stock assessment report for further information regarding the stock assessment model (McGilliard et al. 2020). A full stock assessment document with updated assessment and projection model results is scheduled to be presented in next year's SAFE report. A statistical age-structured model is used as the primary assessment tool for the Bering Sea/Aleutian Islands northern rock sole assessment, a Tier 1 stock. This assessment consists of a population model, which uses survey and fishery data to generate a historical time series of population estimates, and a projection model, which uses results from the population model to predict future population estimates and recommended harvest levels. The data sets used in this assessment include total catch biomass, fishery age compositions, trawl survey abundance estimates and trawl survey age compositions. In a partial assessment year, the full assessment model is not rerun but instead a Tier 1 projection model with an assumed future catch is used to estimate the stock level in the next two years. This incorporates the most current catch information for ABC and OFL recommendations without re-estimating model parameters and biological reference points.

The Tier 1 projection operates within the full assessment model by projecting estimates of the female spawning biomass, age 6+ total biomass, ABC and OFL ahead two years. Since the full assessment model is not rerun in this assessment, the projected values from the 2020 assessment are used to provide ABC and OFL.

Summary of Changes in Assessment Inputs

The 2020 catch was updated to realized year-end catch (25,318 t), which was very close to the projected 2020 catch used in the 2020 assessment (25,800 t). The projected catch in 2021-2023 was very close to the projected future catches used in the 2020 assessment. Catch in 2021-2023 used in the 2021 projections was updated to 45,300 t from 45,700 t to reflect changes in the average catches over the most recent decade.

Summary of Results

For the 2022 fishery, we recommend the maximum allowable ABC of 206,896 t from the updated projection model. This ABC is higher than last year's ABC of 140,306 t and slightly more than last year's projected 2022 ABC of 206,605 t. Reference values are summarized in the following table.

Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2021	2022	2022	2023
M (natural mortality rate)	0.15 (f),0.17 (m)	0.15 (f),0.17 (m)	0.15 (f),0.17 (m)	0.15 (f),0.17 (m)
Tier	1a	1a	1a	1a
Projected total (age 6+) biomass (t)	923,197	1,359,440	1,361,360	1,784,460
Projected Female spawning biomass (t)	294,627	286,381	287,600	320,399
B_0	476,820	476,820	476,820	476,820
B_{MSY}	158,972	158,972	158,972	158,972
F_{OFL}	0.157	0.157	0.157	0.157
$maxF_{ABC}$	0.152	0.152	0.152	0.152
F_{ABC}	0.152	0.152	0.152	0.152
OFL (t)	145,180	213,783	214,084	280,621
maxABC (t)	140,306	206,605	206,896	271,199
ABC (t)	140,306	206,605	206,896	271,199
Status	As determined *last* year for:		As determined *this* year for:	
	2019	2020	2020	2021
Overfishing	no	n/a	no	n/a
Overfished	n/a	no	n/a	no
Approaching overfished	n/a	no	n/a	no

* Projections are based on realized catches of 25,318 t used in place of maximum permissible ABC for 2020 and 45,300 t used in place of maximum permissible ABC for 2021-2023. The 2021-2023 catch was estimated as the average over the past decade of final catches.

Fishery Trends

Updated catch data (NMFS Alaska Regional Office Catch Accounting System via the Alaska Fisheries Information Network (AKFIN) database, http://www.akfin.org) are summarized in Table 2 and indicate lower catches than in recent years as of October 31, 2021. Survey biomass for 2021 is similar, but slightly higher than in 2019 (Table 1). The ratio of total catch to age 6+ modeled total biomass has decreased in recent years (Figure 1).

Figures

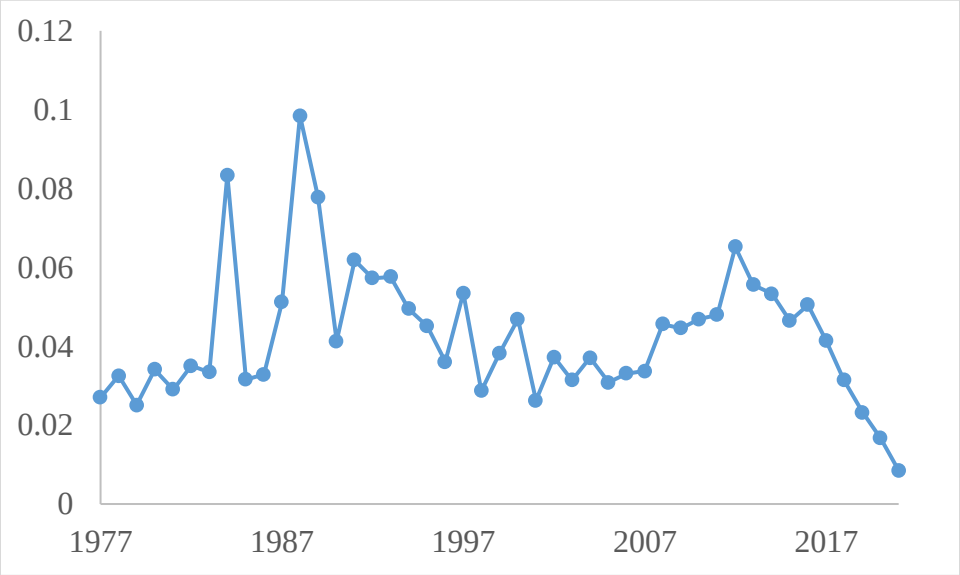

Figure 1. Ratio of total catch to total age 6+ biomass over time for northern rock sole in the Bering Sea and Aleutian Islands, including projected catch and biomass through 2021.

Tables

Table 1. EBS Shelf (standard area), Aleutian Islands, and Northern Bering Sea survey biomass and standard error for northern rock sole.

	EBS Standard Area		Aleutian Islands		Northern Bering Sea	
Year	Bio	Std. Err.	Bio	Std. Err.	Bio	Std. Err.
1982	578.71	74.08				
1983	714.09	81.85				
1984	799.42	81.82				
1985	693.06	58.77				
1986	1,021.23	83.74				
1987	1,269.58	91.22				
1988	1,478.97	101.51				
1989	1,323.30	91.08				
1990	1,382.91	89.02				
1991	1,585.26	95.97				
1992	1,548.69	112.28				
1993	1,994.68	122.05				
1994	2,723.80	223.25				
1995	2,179.97	130.54				
1996	2,062.35	121.95				
1997	2,605.47	190.30	49.91	12.20		
1998	2,168.13	123.52				
1999	1,619.78	162.03				
2000	2,073.29	317.09	44.26	6.22		
2001	2,336.67	259.01				
2002	1,879.60	171.43	51.59	6.98		
2003	2,108.94	196.19				
2004	2,193.82	183.57	51.90	3.90		
2005	2,113.90	150.25				
2006	2,215.37	149.97	77.70	9.78		
2007	2,033.03	278.94				
2008	2,031.62	300.65				
2009	1,538.62	159.00				
2010	2,065.54	203.36	55.29	4.53	21.26	3.64
2011	1,977.10	164.58				
2012	1,920.14	185.89	65.46	7.07		
2013	1,752.59	136.59				
2014	1,857.33	129.33	46.65	4.62		
2015	1,411.71	130.44				
2016	1,460.67	130.97	34.98	4.26		
2017	1,329.78	99.61			53.96	9.14
2018	1,048.34	114.61	44.12	4.49		
2019	970.17	91.57			99.04	17.75
2021	1,026.38	86.27				

Table 2. Catches of northern rock sole in the Bering Sea and Aleutian Islands
* Catch as of October 31, 2021.

Year	Foreign	Joint-Venture	Domestic	Total
1977	5,319			5,319
1978	7,038			7,038
1979	5,874			5,874
1980	6,329	2,469		8,798
1981	3,480	5,541		9,021
1982	3,169	8,674		11,843
1983	4,479	9,140		13,619
1984	10,156	27,523		37,679
1985	6,671	12,079		18,750
1986	3,394	16,217		19,611
1987	776	11,136	28,910	40,822
1988		40,844	45,522	86,366
1989		21,010	47,902	68,912
1990		10,492	24,761	35,253
1991			56,058	56,058
1992			52,723	52,723
1993			64,261	64,261
1994			59,607	59,607
1995			55,029	55,029
1996			46,929	46,929
1997			67,815	67,815
1998			33,644	33,644
1999			41,090	41,090
2000			49,668	49,668
2001			29,477	29,477
2002			41,867	41,867
2003			36,086	36,086
2004			48,681	48,681
2005			37,362	37,362
2006			36,456	36,456
2007			37,126	37,126
2008			51,276	51,276
2009			48,716	48,716
2010			53,200	53,200
2011			60,534	60,534
2012			75,945	75,945
2013			59,751	59,751
2014			51,690	51,690
2015			45,468	45,468
2016			45,072	45,072
2017			35,106	35,106
2018			28,197	28,197
2019			25,832	25,832
2020			25,514	25,514
2021			13,860	13,860

References

McGilliard, C.R., Ianelli, J., Punt, A.E., Wildebuer, T., Nichol, D., and Haehn, R. 2020. Assessment of the northern rock sole stock in the Bering Sea and Aleutian Islands In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea and Aleutian Islands. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage AK 99510. https://apps-afsc.fisheries.noaa.gov/refm/docs/2020/BSAIrocksole.pdf